IN THE ABSTRACT:

Please amend the abstract as indicated by the clean copy of the amended abstract in Appendix E, and the marked-up copy of the amended abstract in Appendix F, attached hereto.

REMARKS

Reconsideration of the application is respectfully requested for the following reasons:

1. Formalities

The specification and abstract have been revised to correct various minor idiomatic and grammatical errors. Because the changes are all formal in nature, it is respectfully submitted that the changes do not involve new matter.

2. Rejection of Claim 4 Under 35 USC §112, 2nd Paragraph

This rejection has been addressed by re-writing claim 4 in independent form to include all of the limitations of claim 1, except for the contradictory recitation of the second electrode being on the first substrate.

3. Rejection of Claims 1-3 and 5 Under 35 USC §102(b) in view of U.S. Patent No. 4,620,123 (Farrall)

This rejection is respectfully traversed on the grounds that while the Farrall patent discloses a piezoelectrically actuated switch having a structure similar to that of the claimed apparatus, it does not disclose a piezoelectrically tunable capacitor, as is now positively recited in claims 1 and 4.

The difference between a tunable capacitor and a switch is that the tunable capacitor requires precise control of the distance between electrodes, whereas a switch simply requires that the "electrodes" or contacts be brought together. In general, switch structures are not suitable for use as a capacitors,

The Farrall patent is clearly directed to a switch, and not a capacitor, and includes teachings that would lead the ordinary artisan away from using the structure disclosed therein as a tunable capacitor. For example, Farrall includes an extensive discussion of the problem that the "*closing contact force available from a piezoelectric bender is small*," which leads to the problem of high contact resistance (col. 2, lines 31-45). As a result, the first two objectives of Farrall's switch structure are to reduce contact resistance (col. 3, lines 22-38. Increasing the force by which contacts engage each other is use of the switch structure in a tunable capacitor. A person of ordinary skill in the art would not find any suggestion in these passages that the structure disclosed by Farrall is useful in a capacitor, rather than a multiple circuit switch.

In item 2 of the Official Action, the Examiner refers to Figs. 1 and 5, and the last paragraph of col. 6. These figures, and the corresponding passage in col. 6, are not even remotely suggestive of a tunable capacitor, as claimed. Instead, the cited paragraph in col. 6 is concerned exclusively with the problem of contact resistance, the solution to which is to use multiple benders to increase the contact force. The present invention, in contrast, uses the multiple piezoelectric elements to provide a gimbal effect that maintains the electrodes in a parallel relationship in order to provide more controllable and uniform capacitance changes in response to bending of the piezoelectric elements.

Because the Farrall patent does not disclose or suggest a capacitor structure, as claimed, it is respectfully submitted that the Farrall patent neither discloses nor suggests the claimed invention, and withdrawal of the rejection of claims 1-3 and 5 in view of the Farrall patent is respectfully requested.

4. Rejection of Claim 4 Under 35 USC §103(a) in view of U.S. Patent Nos. 4,620,123 (Farrall) and 4,868,448 (Kornrumpf)

This rejection is respectfully traversed on the grounds that the Kornrumpf patent, like the Farrall patent, does not disclose or suggest application of the structures disclosed therein to a

tunable capacitor. Instead, Kornrumpf discloses a piezoelectric switching matrix having simplified wiring.

Furthermore, it is respectfully noted that the structure illustrated in Fig. 2 of Kornrumpf, which shows contacts on a second substrate, does not involve placement of the contacts on a central portion of a support, as claimed, but rather involves contacts 50 that are at fee ends of the supports, in a manner that is exactly opposite the claimed invention. Placement of contacts in the manner described by Kornrumpf would eliminate the gimbal effect of the present invention since it would be impossible to maintain electrodes thus mounted in a parallel relation. This contrary teaching would certainly have been considered by the ordinary artisan, and is a good indication of non-obviousness. As explained in MPEP 2141.02, p. 2100-107 "*A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention*" (emphasis in the original).

Because neither the Farrall patent nor the Kornrumpf patent discloses or suggests the claimed capacitor structure, each reference including teachings that lead away from suggestion of a capacitor, it is respectfully submitted that the rejection of claim 4 under 35 USC §103(a) is improper and should be withdrawn.

Having thus overcome each of the rejections made in the Official Action, withdrawal of the rejections and expedited passage of the application to issue is requested.

Respectfully submitted,
BACON & THOMAS, PLLC

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APPENDIX A
(Clean Copy Of Amended And New Claims)

a1

1. (Amended) A piezoelectric tunable capacitor, comprising:

a substrate;

a support comprising a central portion and at least two elastic arms extending from said central portion and in a substantially symmetric arrangement relative to said central portion wherein an end of said elastic arms is fixed to said substrate, with said central portion spaced from said substrate at a predetermined distance;

a first capacitor electrode positioned on said central portion of said support;

a second capacitor electrode positioned on said substrate, facing said central portion of said support; and

at least two piezoelectric films adhered to said at least two arms of said support respectively at positions substantially symmetric to said central portion of said support;

whereby, by applying a voltage to said piezoelectric films, the distance between said first electrode and said electrode changes to change a capacitance of the tunable capacitor.

2. (Amended) The piezoelectric tunable capacitor according to claim 1 wherein said support comprises an elastic strip.

3. (Amended) The piezoelectric tunable capacitor according to claim 1 wherein said support comprises at least three elastic arms extending from said central portion.

4. (Amended) A piezoelectric tunable capacitor, comprising:

a substrate;

a support comprising a central portion and at least two elastic arms extending from said central portion and in a substantially symmetric arrangement relative to said central portion wherein an end of said elastic arms is fixed to said substrate, with said central portion spaced from said substrate at a predetermined distance;

a' cncl'd.

a first capacitor electrode positioned on said central portion of said support;

at least two piezoelectric films adhered to said at least two arms of said support respectively at positions substantially symmetric to said central portion of said support;

a second substrate positioned above said support; and

a second capacitor electrode positioned on said second substrate, facing said central portion of said support,

whereby, by applying a voltage to said piezoelectric films, the distance between said first electrode and said electrode changes to change a capacitance of the tunable capacitor.

a2 Rule 1.126

6 ~~5.~~ (New) The piezoelectric tunable capacitor according to claim 4 wherein said support comprises an elastic strip.

7 ~~6.~~ (New) The piezoelectric tunable capacitor according to claim 4 wherein said support comprises at least three elastic arms extending from said central portion.